

Highway Safety Literature

**An Announcement
of Recent Acquisitions. . .**

**HSL No. 71-24
September 10, 1971**



**SPECIAL NOTICE
Page 27**

THIS ISSUE CONTAINS:

**HS-009 677 - HS-009 755
HS-800 516**

INTRODUCTION

Publications announced in *Highway Safety Literature* include the most recent additions to the collection of the NHTSA Scientific & Technical Information Service. Subject areas covered include all phases of highway, motor vehicle, and traffic safety, especially those encompassed by the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966.

Individual issues of *HSL* are numbered according to the year and the issue number within that year; thus, 71 designates the year and 1, 2, 3, etc. the individual issues. To aid the user in location citations by the HS-number, the cover bears the inclusive entry numbers for each issue.

Entries in *HSL* are arranged according to the revised NHTSA Subject Category List shown in the Table of Contents. The List is a two-level arrangement consisting of five major subject fields subdivided into 59 subject groups. Documents related directly to the National Highway Traffic Safety

Administration (NHTSA) are announced in a separate section headed NHTSA DOCUMENTS and are numbered in five distinct series: NHTSA Accident Investigation Reports (HS-600 000 series), NHTSA Compliance Test Reports (HS-610 000 series), NHTSA Contractors Reports (HS-800 000 series), NHTSA Staff Speeches, Papers, etc. (HS-810 000 series), and NHTSA Imprints (HS-820 000 series). For NHTSA DOCUMENTS in series HS-600 000 and HS-610 000, individual full case reports are available for inspection at the National Highway Traffic Safety Administration. HS-800 000 series and HS-820 000 series are available for sale/or purchase from NTIS or GPO (see page ii). Although announced together in a separate section, these documents are also assigned specific subject categories for machine retrieval.

A document which contains a number of separate articles is announced as a complete volume in the subject category most applicable to it as a whole. Entries for the individual articles appear in their most specific subject category.

SAMPLE ENTRIES

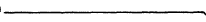
Subject Category Array 

NHSB Accession no..... HS-800 218 Fld. 5/21; 5/9

Title of document..... AN INVESTIGATION OF USED CAR SAFETY STANDARDS--SAFETY INDEX: FINAL REPORT. VOL. 6 - APPENDICES G-L

Personal author(s)..... by E. N. Wells; J. P. Fitzmaurice; C. E. Guilliams; S. R. Kalin; P. D. Williams

Corporate author..... Operations Research, Inc.

Collation 

Publication date..... 12 Sep 1969 150p
Contract FH-11-6921
Report no. ORI-TR-553-Vol-6; PB-190 523

Abstract..... Appendices G-L to this study of used car safety standards include: indenture model diagrams for classes I-IV motor trucks; degradation, wear, and failure data for motor truck classes I-IV; and safety index tables for classes I-IV motor trucks.

HS-004 497 Fld. 5/19

AUTO THEFT--THE PROBLEM AND THE CHALLENGE

by Thomas A. Williams, Sr.

Journal citation . . . Published in *FBI Law Enforcement Bulletin* v37 n12 p15-7 (Dec 1968)

Gives figures on the extent of the auto theft problem and comments on antitheft device: available now or in the planning stage.

Search terms: Theft; Theft protection; Fix; Stolen cars

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NOTE: Material published in Highway Safety Literature (HSL) is intended for the information and assistance of the motor vehicle and highway safety community. While brands names, equipment model names and identification, and companies may be mentioned from time to time, this data is included as an information service. Inclusion of this information in the HSL should not under

**AVAILABILITY OF DOCUMENTS
AND
INSTRUCTIONS FOR ORDERING**

Department of Transportation personnel may borrow copies of publications directly from the NHTSA. Outside the Washington, D.C. area, phone (202) 426-2768. In Washington, D.C. area, use government ID, phone 118-62768. Non-DOT personnel should contact their company or agency libraries for assistance.

Journals cite may be obtained through most research libraries.

Contractors' reports and other documents can usually be obtained as indicated under AVAILABILITY. However, there is no certainty that retention copies will be available for more than a limited period after a document is issued.

The more common distribution sources are identified by symbols which are explained below:

NTIS: National Technical Information Service, Springfield, Va. 22151. *Order by accession number: HS, AD, or PB.* Prepayment is required by NTIS (CFSTI) coupon (GPO coupons are not acceptable), check, or money order (made payable to the NTIS), *HC* (Paper copy; full size original or reduced facsimile) \$3.00 up; *MF* (microfiche approximately 4x6" negative sheet

film; reader required) \$0.95.

GPO: Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. Give corporate author, title, personal author, and report number. Prepayment is required by GPO coupon (NTIS [CFSTI] coupons are not acceptable), check or money order (made payable to the Superintendent of documents).

HRB: Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D. C. 20418.

NHTSA: National Highway Traffic Safety Administration General Services Division, Washington, D.C. 20591 (Telephone (202) 426-0874),

SAE: Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. Order by SAE report numbers. Prices given are list; discounts are available to members and sometimes to libraries and U. S. Government Agencies. Prepayment is required; orders without payment are subject to a \$1 handling charge.

IMPORTANT NOTICE

WHEN REQUESTING a document, to be absolutely sure you receive what you order, give the accession number (HS, PB, AD number) or report number (in cases such as an SAE document), title of report, and the personal or corporate author (whichever is cited). When requesting an HS-numbered document from NTIS (CFSTI), add DOT/to the prefix HS-; example HS-800 000 should be ordered as DOT/HS-800 000.

1/0 ACCIDENTS

1/1 Emergency Services

HS-009 677 Fld. 1/1; 4/2

EMERGENCY MEDICAL SERVICES

National Safety Council.

[1970] 9p 12 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support for state highway safety programs on emergency medical services. Authorities have estimated that 20,000 die needlessly and another 25,000 are permanently disabled annually because of inadequate emergency medical care at the scene of an accident and in transit to a hospital. The standard requires each state to develop an adequate emergency medical services response system. The provisions for such a system are listed, and the requirements briefly noted. The rationale for the implementation of these systems is discussed. A pattern newspaper release and a pattern public service announcement are included.

Search terms: Highway safety programs; Highway safety standards; Emergency medical services; State laws; Safety propaganda; Community support

1/3 Investigation

HS-009 678 Fld. 1/3

1970 17 refs

Presented at Tenth International Study Week in Traffic and Safety Engineering, World Touring and Automobile Organization, Permanent International Assoc. of Road Congresses, Rotterdam, Netherlands, 9 Sep 1970. Paper on Theme 4.

The development of a matrix for categorizing and analyzing highway and safety phenomena and activity is described. Accidents are broken down into three phases: pre-crash, crash, and post-crash. The factors involved are also broken down in terms of humans, vehicles and equipment, and environment. Examples of the use of this matrix to classify loss-generating situations are provided and discussed. It is suggested that this type of loss-centered approach should become the customary frame of reference for those concerned professionally with highway safety.

Search terms: Precrash phase; Crash phase; Postcrash phase; Human factors; Environmental factors; Accident analysis; Accident causes; Accident factors; Damage costs; Injury severity; Human acceleration tolerances; Driver vehicle road interfaces; Matrix reduction; Highway safety

HS-009 679 Fld. 1/3

PREPARATION OF COLLISIONS DIAGRAMMS

by Paul C. Box

Published in *Public Safety Systems* v35 n4 p13-6 (Jul-Aug 1970)

Collision diagrams are used to analyze traffic accidents occurring at a given

HS-009 680 Fld. 1/3

DEATH RIDES THE HIGH ROAD

by Robert L. Kuhn

Published in *Highway Patrolman* v35 n1 p10-3, 44-6 (Mar 1971)

Almost eight Americans per minute are injured in automobile accidents. Accidents are as often caused by psychological factors: complacency, inattention, carelessness, frustration, as by mechanical failure. The "anatomy of an accident" is given. "Panic preventers," a list of what to do in emergency situations, "The ten commandments of motoring," and "How to drive and stay alive" are included.

Search terms: Accident avoidance; Defensive driving; Driver emergency responses; Psychological factors; Attention lapses; Driver behavior; Injuries; Accident reconstruction; Accident causes

1/4 Locations

HS-009 681 Fld. 1/4; 1/3; 4/2

IDENTIFICATION AND SURVEILLANCE OF ACCIDENT LOCATIONS

National Safety Council.

[1970] 6p 5 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support for state highway safety programs.

1/4 Locations (Cont'd.)

HS-009 681 (Cont'd.)

public service announcement are included.

Search terms: Highway safety programs; Accident location; Accident risk forecasting; Safety propaganda; Community support

HS-009 683 Fld. 1/5

FREEWAY FATAL ACCIDENTS, 1961 AND 1962

by Roger T. Johnson

California Div. of Highways

Nov 1963 52p

The combined 1961 and 1962 accident and fatality rates for California roads are reported. By comparing accident rates for freeways with all other kinds of roads, it has been shown that 406 lives were saved in 1961 and 426 lives were saved in 1962 through the use of freeways. Half of freeway fatal accidents are single vehicle accidents, and there are more single vehicle-fixed object accidents than any other type. Median barriers have reduced cross median accidents. Of all freeway fatalities, 12% occur on ramps or involve ramp maneuvers. About 30% occur between 11 p.m. and 3 a.m. Drivers between 19 and 23 years of age cause one-fifth of all freeway fatalities. Drinking drivers cause 36%. Driver error and driver physical shortcomings play an important role.

Search terms: Young adult drivers; Ramps; Freeway driving; Age factor in accidents; Drinking drivers; Fatality rates; Driver physical fitness; Single vehicle accidents; Fatality causes; Accident types; California; Accident statistics; Environmental factors; Rear end collisions; Pedestrian fatalities; Time of accidents; Driver error caused accidents; Accidents by vehicle age; Accident location; Vehicle fixed object collisions; Driver intoxication; Accident case reports

HS-009 684 Fld. 1/5

THE CHILD IN DETROIT TRAFFIC 1970

by John Logan

This analysis was compiled in order to determine the major causes of child traffic injury and fatal accidents. The report covers: (1) actions of child pedestrians and bicycle riders injured or killed in traffic; (2) time of day and day of week of child accidents; (3) location of accident (main or residential street at, or not at, intersection); (4) accidents by age group; (5) accidents by precinct; (6) analysis of accidents occurring while child was going to or from school; (7) school attending (public or parochial).

Search terms: Accident analysis; Accident statistics; Age factor in accidents; Accident studies; Accident location; Fatality rates; Bicycle accidents; Pedestrian accidents; Child injuries; Sex factors in accidents; Time of accidents; Vehicle bicycle collisions; Vehicle pedestrian collisions; Bicycle rider behavior; Intersection collisions; Day of week; Injury statistics

1/5 Statistical Data

HS-009 682 Fld. 1/5

RAN-OFF-ROAD MOTOR VEHICLE TRAFFIC ACCIDENTS IN ILLINOIS - 1963

Illinois Div. of Highways

[1964] 20p

Rural ran-off-road accidents are analyzed. Whether the motor vehicle left the road accidentally or to avoid collision is irrelevant in classifying the event. The study was confined to those accidents occurring in rural locations since ran-off-road accidents represent 17% of all rural and nearly 23% of fatal rural mishaps reported during the year. Differences of conditions and circumstances associated with the accident type were separated into those occurring on numbered State highways and those occurring on other than numbered State highways.

Search terms: Ran off road accidents; Illinois; Single vehicle accidents; Accident statistics; Accident analysis; Rural accidents; Age factor in accidents; High speed caused accidents; Property damage accidents; Environmental factors; Driver age; Loss of control; Accident types; Accident location; Time of accidents; Day of

HS-009 685 Fld. 1/5; 2/4

EXPRESSWAY MEDIAN BARRIER RAILS. BEFORE AND AFTER ACCIDENT RATES, 1963-1968

by Michael J. Goodge

Connecticut Dept. of Transp.

Nov 1969 19p 2 refs
Report no. TR-11

Prepared in cooperation with Bureau of Public Roads.

The purpose of this study was to determine the effect of the median rail on accident rates and severities. Of particular interest was the effect of the median rail on head-on accidents. Although median-related accidents rose 35%, all the overall severity rates were lowered. Head-on collisions dropped from 0.7% to 0.1%.

Search terms: Median barriers; Age

HS-009 686 Fld. 1/5

THE SMALL CAR IN MOTOR VEHICLE TRAFFIC ACCIDENTS IN ILLINOIS 1963

Illinois Div. of Highways

Feb 1965 16p

This report is an analytical study of the 1963 traffic accident experience of small cars as contrasted to that of all other vehicles. The number of small cars registered in 1963 increased 9 percent over 1962. The annual death toll involving small cars increased more than three times that of registrations, or 28 percent. Registrations of other vehicles were up 2 percent and traffic deaths up 5 percent over 1962. This resulted in a death rate per 10,000 registered small cars considerably greater than the similar rate for other vehicles for the year.

Search terms: Compact automobile accidents; Accident statistics; Fatality rates; Illinois; Accidents by vehicle size; Vehicle registration; Accident severity; Age factor in accidents; Driver characteristics; Environmental factors

2/0 HIGHWAY SAFETY

HS-009 687 Fld. 2/0

THE GOVERNOR'S TRAFFIC SAFETY CONFERENCE, MADISON, 13 SEP 1963. REPORT

Wisconsin Univ.

1963 21p

Highlights from the Governor's Traffic Safety Conference are presented. All aspects of the state's program were

tion and operation of the driver licensing program; vehicle inspection; school traffic safety and public safety education programs; and the traffic safety improvement program.

Search terms: Wisconsin; Accident rates; Fatality rates; Uniform Vehicle Code; Law uniformity; Police traffic services; Child safety education; Traffic engineering; Highway engineering; Accident reports; Safety education; Driver licensing; Highway safety; Traffic surveys; Accident location; Driver education; Highway safety programs; Conferences.

2/1 Breakaway Structures

HS-009 688 Fld. 2/1; 2/4

DESIGNING FAIL-SAFE STRUCTURES FOR HIGHWAY SAFETY

by F. J. Tamanini

Federal Hwy. Administration

Published in *Public Roads* v36 n6 p121-32 (Feb 1971)

18 refs

Presented at National Structural Engineering Meeting, American Society of Civil Engineers, and 19th Annual Arizona Roads and Streets Conference, Apr 1970.

Highway research has met, and is continuing to meet, the challenge to help stem the enormous accident toll of the nation's highway system. In addition to numerous innovations on the roadway itself, revisions to the roadside are virtually eliminating lethal targets at which errant vehicles often are directed. Not only are roadside appurtenances being planned-out of probable collision zones.

mented each month by state highway departments. Fail-safe structures must be designed for both strength to perform the tasks for which they were built, and weakness to yield under impact. The author reviews some of the designs that incorporate these seemingly incompatible characteristics, and discusses some of the problems encountered in fail-safe structure design.

Search terms: Highway safety; Sign design; Highway improvements; Safety design; Breakaway structures; Breakaway sign supports; Barrier collision tests; Energy absorbing barriers; Fail safe systems; Vehicle fixed object collisions; Roadside hazards; Design standards; Breakaway light poles; Impact tests; Impact attenuators; Sign impact protection

2/3 Debris Hazard Control and Cleanup

HS-009 689 Fld. 2/3; 4/2

DEBRIS HAZARD CONTROL AND CLEANUP

National Safety Council.

[1970] 6p 3 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support for state highway safety programs on debris hazard control and cleanup. Background information shows physical blockage of traffic, distraction of passing motorists, and the presence or spillage of hazardous substances create danger of further crashes at the scene of an accident. In order to restore the area to a safe

2/3 Debris Hazard Control and Cleanup (Cont'd.)

HS-009 689 (Cont'd.)

pattern public service announcement are included.

Search terms: Debris removal; Hazards; Highway safety programs; Highway safety standards; Accident factors; Safety propaganda; Hazardous materials; Community support

2/4 Design and Construction

HS-009 690 Fld. 2/4

WHAT MAKES PAVEMENTS SLIPPERY?

by W. E. Meyer

Pennsylvania State Univ.

1971 9p 17 refs

Report no. SAE-710572

Presented at SAE mid-year meeting, Montreal, 7-11 Jun 1971.

Pavements, no matter what their construction and surface features, provide no traction or skid resistance when they are covered with a deep layer of water. Pavement design and other factors inhibiting or promoting hydroplaning are discussed, as are possible remedial measures. This leads naturally into a review of the pavement surface features that control the reduction of skid resistance with speed. The polishing of pavement surfaces and those of aggregate particles is discussed in the light of present knowledge and practices. Finally, the problems which the future might bring and the options for their solutions are highlighted.

Search terms: Pavements; Pavement skid resistance; Hydroplaning; Wet road conditions; Pavement surface tex-

HS-009 691 Fld. 2/4

HIGHWAY SKID RESISTANCE — A PLAN OF ACTION

by W. A. Goodwin

Tennessee Univ.

1971 10p 23 refs
Report no. SAE-710573

Presented at SAE mid-year meeting, Montreal, 7-11 Jun 1971.

The evolution of road building has occurred because of the need to move people and goods economically and safely between their points of origin and destination. Engineers over the decades have built roads to meet these needs with varying degrees of success. One major goal throughout this period has been that of providing all-weather, skid-safe travel for the motoring public. In providing skid-safe travel, the highway engineer has first resorted to studying the task and then developing solutions. This paper presents the present state of knowledge regarding the influence of highway geometrics and pavement surface on skid resistance. It summarizes the techniques of building a pavement initially for skid resistance and also corrective measures for existing pavements.

Search terms: Pavement friction; Pavement skidding characteristics; Pavement surface texture; Grooving; Pavement skid resistance; Pavement wear; Tire treads; Surface friction; Skid resistance tests; Surface treatment; Tire pavement interface; Aggregates

AVAILABILITY: SAE

HS-009 692 Fld. 2/4; 2/6; 4/2

HIGHWAY DESIGN, CONSTRUCTION AND MAINTENANCE

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support for state highway safety programs on highway design, construction and maintenance. Historical background highlights early and developing problems of poor design, lack of technical knowhow, and rapidly increasing traffic. The provisions of the standard are briefly noted. A pattern newspaper release and a pattern public service announcement are included.

Search terms: Highway safety programs; Highway safety standards; Highway design; Highway construction; Highway maintenance; Safety propaganda; Community support

2/8 Police Traffic Services

HS-009 693 Fld. 2/8; 4/2

POLICE TRAFFIC SERVICES

National Safety Council.

[1970] 9p 8 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support for state highway safety programs on police traffic services. The background shows the development of specialized traffic units in police departments, and gives some arguments for and against these units. Areas of greatest need for assignment of patrol personnel are briefly noted. The standard requires that each state have a program to insure efficient and effective police services, and the minimum provisions of the standard are given. A pattern newspaper release and a pattern public service announcement are included.

forcement; Police training; Safety propaganda; Community support

[1970] 6p 9 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

FUNCTION, DESIGN AND APPLICATION. VEHICLE PERCEPTIBILITY 3.

Stichting Wetensch. Onderz. Verkeersvlghd. (Neth.)

1970 59p 10 refs
Report no. SWOV-1970-5

Red warning triangle signs are used to warn approaching drivers that there is a stationary vehicle on the road. There seems to be a need for two warning systems, one for vehicles stationary on the road and one for vehicles stationary near the road. Standards for warning triangles have been established, covering recognizability distance, wind stability, and design. Tests with the triangles are described. Other aspects discussed are: detecting and estimating differences in vehicle speeds; collisions with stationary vehicles; and the differences in daylight, dusk, and night visibility distances of the triangles.

Search terms: Reflectorized signs; Disabled vehicles; Wind; Sight distances; Stopping distance; Sign reflectance; Sign tests; Night visibility; Red warning triangles; Vehicle visibility; Warning signs; Sign standards; Sign visibility; Speed differentials; Rear end collisions; Vehicle vehicle collisions

2/9 Traffic Control

HS-009 694 Fld. 2/9

BRIGHTNESS AND BRIGHTNESS RATIO AS FACTORS IN THE ATTENTION VALUE OF HIGH-WAY SIGNS

by Richard Pain

Grumman Aircraft Engineering Corp.

Published in *Highway Research Record* n275 p32-40 (1969)

13 refs

Sponsored by Committee on Visibility and presented at Highway Research Board 48th annual meeting.

By measuring the subjective reactions and eye movements of subjects looking at pairs of neutral gray chips varying in either brightness, brightness ratio, or brightness and brightness ratio, it was possible to assess the role of these parameters in attention value. Each variable controlled attention when unconfounded. When the two parameters varied simultaneously, brightness ratio predominated, but a high brightness enhanced the attention-getting value of high contrast. This was more evident in the negative than in the positive contrast direction. It is suggested that addition of a factor considering high relative brightness in combination with high relative brightness ratio would refine the Forbes et al models of highway sign attention value.

Search terms: Eye movements; Brightness; Contrast; Mathematical models; Highway signs; Backgrounds; Sign visibility

HS-009 695 Fld. 2/9; 4/2

TRAFFIC CONTROL DEVICES

National Safety Council

This fact sheet is intended for use in promoting public support for state highway safety programs on traffic control devices. Control of traffic was originally a local police responsibility. Early hostility toward the automobile was reflected in a wide variety of restrictions, varying for each jurisdiction. The standard requires each state to have a program for identifying deficiencies in existing traffic control devices, upgrading them, installing new devices, and adapting preventive maintenance programs. A pattern newspaper release and a pattern public service announcement are included.

Search terms: Highway safety programs; Highway safety standards; Traffic control devices; Traffic control device uniformity; Safety propaganda; Community support

HS-009 696 Fld. 2/9

PAVEMENT MARKING — RX NEEDED

by John M. Dale

Published in *Better Roads* v40 n8 p18-20 (Aug 1970)

3 refs

The evolution of the present system for marking pavement is presented. A new system of highway marking, which indicates direction of traffic flow, is suggested as one corrective measure to some of the confusion in our present system.

Search terms: Pavement edge markings; Centerline markings; Pavement markings

HS-009 697 Fld. 2/9

RED WARNING TRIANGLES

This fact sheet is intended for use in promoting public support for state highway safety programs on traffic courts. The background of the traffic court standard and the impact of judicial systems and their administration on highway safety are given, the purpose

HS-009 698 Fld. 2/10; 4/2

TRAFFIC COURTS

National Safety Council.

[1970] 9p 1 ref

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

2/9 Traffic Control (Cont'd.)

HS-009 698 (Cont'd.)

summarized, some arguments and their answers shown, and sources and guidelines for financing traffic courts explained. A pattern newspaper release and a pattern public service announcement are included.

Search terms: Traffic courts; Highway safety programs; Traffic law violations; Financing; Safety propaganda; Community support

HS-009 699 Fld. 2/10

TRAFFIC COURTS

by James P. Economos

American Bar Assoc.

1963 6p

Advance paper prepared for presentation at Liberty Mutual's Council on the Automobile and Public Health, Panel 4, Boston, 22 Nov 1963.

This report provides a number of guidelines to be used by the traffic court judge in his approach to his work and the example he sets by his manner, all of which make an impression on the traffic violator. The judge's duties and responsibilities are outlined. Qualification of court personnel and organizational relationship to the rest of the judicial system are discussed.

Search terms: Traffic courts; Traffic law enforcement; Traffic law violations; Traffic law violators

2/11 Traffic Records

HS-009 700 Fld. 2/11

TRAFFIC RECORDS

National Safety Council.

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support for state highway safety programs on traffic records. Background is given showing the problems of inaccurate, incomplete, and non-uniform reporting of accident data. The standard is summarized, listing its minimum provisions. The intent of the standard is to require each state to maintain a traffic records system adequate to provide reliable means of identifying trends in highway accidents. A pattern newspaper release and a pattern public service announcement are included.

Search terms: Highway safety programs; Highway safety standards; Traffic records; Accident records; Accident investigation; State laws; Safety propaganda; Community support

3/0 HUMAN FACTORS

3/1 Alcohol

HS-009 701 Fld. 3/1; 4/2

ALCOHOL IN RELATION TO HIGHWAY SAFETY

National Safety Council

[1970] 10p 13 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support for state highway safety programs on alcohol in relation to highway safety. The background of implied consent laws, the role of alcohol in traffic fatalities, and blood alcohol levels presumptive of intoxication are discussed; requirements and specifications of the standards are mentioned; the rationale for campaigns against drinking drivers is presented.

pattern newspaper release and a pattern public service announcement are included.

Search terms: Driver intoxication; Alcohol laws; Drinking drivers; Blood alcohol levels; Fatalities; Implied consent laws; Accident factors; Alcohol effects; Highway safety programs; Safety propaganda; State laws; Community support

HS-009 702 Fld. 3/1

A CLASSROOM APPROACH TO DWI

by Ernest I. Stewart

Published in *Traffic Safety* v71 n2 p12-4, 40 (Feb 1971)

In January 1964, members of the Phoenix Municipal Court met with police officials and faculty members from Arizona State University and Columbia University to discuss better ways of handling the drunk driver problem in the city. Up to that time, the drunk driver problem had been handled only as a criminal matter with no effort made to educate the drunk driver. In 1966 the first Phoenix DWI (drinking while driving) course opened. It consists of four sessions: 1) The Drinking Driver; 2) Alcohol and Driving Skills; 3) Problem Drinking: the student is assisted in finding ways to avoid future DWI behavior; 4) Personal Action: the student is briefed on how to analyze his own situation with alcohol. Every effort is made to show the students that the instructors do care and that their problem is correctable. Results have been encouraging but a systematic formal evaluation of the course, based on subsequent driving records of former students, is needed.

Search terms: Drinking drivers; Driver attitudes; Driver counseling; Driver improvement; Driver improvement schools; Alcohol laws; Driver prosecution; Driver rehabilitation; Alcohol education; Alcoholism; Pro-

HS-009 703 Fld. 3/1

A LEGISLATOR LOOKS AT DRINKING DRIVERS

by Edward J. Speno

Published in *Analogy* n10 p10-6 (1971)

The efforts of the state of New York to do something about drinking drivers include passage of a breathalyzer law, and establishment of an alcoholic countermeasures program in Nassau County, funded by the federal government. The question of constitutionality of the breathalyzer law is discussed and the reduction in traffic accidents in Britain, attributed to their breathalyzer law is reported. Identification and control of the drinking driver is a primary aim of the alcohol countermeasures program. In addition, a "Crisis Intervention Center" will operate to provide transportation home for drivers too intoxicated to drive, and will offer counseling for the drinker with emotional problems.

Search terms: Breathalyzers; Alcohol breath tests; Drinking drivers; New York; Alcohol laws; Alcohol usage deterrents; Constitutional law; Driver intoxication; Road Safety Act of 1967 (Great Britain); Alcohol blood tests; Accident rates; Great Britain; Federal aid; Driver prosecution; Alcoholism; Arrests

HS-009 704 Fld. 3/1

A CHALLENGE FOR LAW ENFORCEMENT

by James J. Hegarty

Published in *Analogy* n10 p17-20

n.d.

Special issue on drinking drivers.

Law enforcement hasn't been able to succeed yet in its battle against the drunken driver. There is a lack of judicial

cedures, drunk driving seen as a minor crime by sympathetic juries, inability on the part of the law enforcement officer to detect the drinking driver, lack of preparedness, experience, and training of the prosecutor, and too much delay between the offense and the trial. One problem that could be solved on a national basis is the legality of the chemical tests. Once the .10 blood alcohol percentage is universally accepted, there would be more judicial support. All law enforcement agencies should have as a primary goal the basic education of the public and the police on all phases of chemical testing.

Search terms: Law enforcement; Drinking drivers; Alcohol laws; Implied consent laws; Blood alcohol levels; Alcohol education; Driver intoxication; Driver prosecution

HS-009 705 Fld. 3/1; 2/10

THE DRINKING DRIVER IN COURT

by E. W. Halloran

Published in *Analogy* n10 p21-5

n.d.

Special issue on drinking drivers

The traffic courts face many problems in handling drinking driver cases: reluctance of the police and sheriffs' offices to make traffic arrests because of the lack of support and interest of the traffic judges, failure of the traffic judges to take advantage of the information and research available on the subject, and the general tendency of the judges to minimize the offense. Well-thought-out sentences and the inclusion of an educational phase after conviction were tried in Arizona with good results. The American Judicature Society sponsors a college for the training of judges of Courts of First Jurisdiction in traffic and misdemeanor cases in Alabama and successive years will see the commencement of regional and state services.

tion with other agencies; Traffic courts; Drinking drivers; Psychological factors; Law enforcement; Police law enforcement responsibilities; Alcohol laws; Driver prosecution; Driver rehabilitation; Penalties

HS-009 706 Fld. 3/1

THE REAL PROBLEMS IN DRUNK DRIVING CASES

by Edward V. Hanrahan

Published in *Analogy* n10 p26-31

n.d.

Special issue on drinking drivers.

The public has learned to live with and ignore the fact that one half of the 50,000 people who die each year as a result of automobile accidents die in accidents involving drinking drivers. The problem lies in the attitude of people. The drinking driver is not seen as the dangerous person he actually is, who has broken the law and is perhaps responsible for the injury or death of some persons, but as our next door neighbor. This sentimental view of the drinking driver is also all too often shared by the jury, the prosecutor and the judge. In order to correct this situation, the public has to be made aware of the magnitude of the problem, its seriousness, and the need for strict and speedy enforcement of existing laws.

Search terms: Drinking drivers; Law enforcement; Law enforcement effect on accident rates; Psychological factors; Public opinion; Alcohol laws; Driver intoxication; Alcohol education; Driver prosecution

3/2 Anthropomorphic Data

HS-009 707 Fld. 3/2; 2/4

HEART RATE AS A MEASURE IN ROAD LAYOUT DESIGN

HUMAN FACTORS

3/2 Anthroponomorphic Data
(Cont'd.)

HS-009 707 (Cont'd.)

England Road Res. Lab.

1970 27p 3 refs

Report no. RRL-LR-347

It is known that stress, both psychological and physical, along with other factors increases the heart rate. Making the assumption that a poor design of road junction gives rise to greater stress than a good design, experiments have been carried out to determine whether driver heart rate changes can be used as a measure of the stress induced by various designs of road junctions. Statistically significant differences in average heart rates were obtained for different parts of motorway interchanges, the order of merit being as expected from a subjective estimate of their difficulty. A second part of the work investigated instantaneous heart rate rises. It was found that considerable care must be taken in interpreting such changes since very often the control movements required at a junction require sufficient physical effort to produce heart rate changes of the same order as those produced by psychological stress.

Search terms: Driver performance under stress; Heart rate; Interchanges; Stress (physiology); Highway design; Stress (psychology); Driving task analysis; Vehicle control; Measuring instruments

3/4 Driver Behavior

HS-009 708 Fld. 3/4; 2/4

TRAFFIC AND HIGHWAY RESEARCH AND HOW IT MAY BE IMPROVED

by Bruce D. Greenshields

The validity of the present day approach to highway and traffic research is discussed and suggestions for improvement are made. The author proposes that some of the problems related to improving traffic and highway research stem from a lack of any precise method for accurately measuring traffic flow, the ability of the driver, or the design of the highway. Use of instruments to evaluate the highway rather than the driver is suggested.

Search terms: Highway research; Highway design; Traffic research; Traffic flow; Driver behavior research; Driving task analysis; Driver tests; Highway characteristics; Measuring instruments; Research methods

HS-009 709 Fld. 3/4; 3/5

TRAFFIC SAFETY RESEARCH.
A UNIQUE METHOD OF MEASURING ROAD, TRAFFIC, VEHICLE AND DRIVER CHARACTERISTICS

by F. N. Platt

Ford Motor Co.

1962 14p 8 refs

Presented at 4th World Meeting of the International Road Federation, Madrid, 14-20 Oct 1962.

A method of measuring road, traffic, vehicle, and driver characteristics is presented, based on a single theory and measured by a single piece of equipment. The theory is based on the probability of various traffic situations. Experiments were conducted to test procedures and equipment, and the constants and variables involving drivers, vehicles, and roads are described. Practical applications of the method include: traffic engineering; driver education, evaluation, and control; measurement of accident severity; reduction of accident severity.

Search terms: Traffic characteristics; Driver behavior research; Driver education; Driver evaluation devices; Driver characteristics; Driver aid systems; Measuring instruments; Highway characteristics; Driver vehicle road interfaces; Probability theory; Accident severity; Time lapse photography; Safety research; Variables; Traffic engineering; Vehicle characteristics

HS-009 710 Fld. 3/4; 3/9

A PILL . . . A CURB . . . AN AMBULANCE

by William L. Roper

Published in *California Highway Patrolman* v39 n1 p8-9, 24-5, 28-30 (Mar 1971)

Certain drugs that we take may unknowingly impair our driving ability and hence cause accidents. Old age, with slowing of the reflexes, should make one drive with more caution. People should and can be restrained from driving when they have a defect or an illness which may make them dangerous on the road. Psychological factors can be as dangerous as physical factors. A safe driver is wide awake and in good physical and mental condition.

Search terms: Drug effects; Driver mental fitness; Driver physical fitness; Psychological factors; Accident proneness; Driver fatigue; Driver behavior; Age factor in driving; Driver attitudes; Attention; Deliberate accidents; Tailgating; Accident factors

3/5 Driver Education

HS-009 711 Fld. 3/5; 4/2

DRIVER EDUCATION

National Safety Council.

to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support for state highway safety programs in driver education. Introduction and background of driver education courses are given, the purpose and provisions of the standard are explained, a few arguments and answers are shown, and reference sources for financing a driver education program are listed. A pattern public service announcement and a pattern newspaper release are included.

Search terms: Driver education; Highway safety programs; High school driving courses; Driver education standards; State laws; Driver education laws; Commercial driving schools; Community support

3/6 Driver Licensing

HS-009 712 Fld. 3/6; 4/2

DRIVER LICENSING

National Safety Council.

[1970] 7p 15 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support for state highway safety programs in driver licensing. The historical background of driver licensing programs is given, the provisions of the standard are briefly noted, and the rationale for licensing programs discussed. A pattern newspaper release and a pattern public service announcement are included.

Search terms: Driver licensing; Driver

HS-009 713 Fld. 3/6

MICHIGAN DRIVER STATISTICS

by Milo W. Chalfant; Joseph A. Hayes

Michigan Dept. of State

1 May 1970 8p

Report no. MDS-3

This is the second computer-produced driver population report covering Michigan's driver records. A one-fifth sampling was made on the records of 1,107,105 drivers out of the total of 5,724,945. Between July 1968 and May 1970 there was a driver population increase of slightly more than 5%. The percentage of male drivers increased more than the percentage of female drivers. Driver statistics are given by sex and age groups.

Search terms: Michigan; Driver statistics; Driver sex; Driver age; Driver licensing; Driver records; Male drivers; Female drivers; Driver characteristics; Age factor in driving

3/11 Pedestrians

HS-009 714 Fld. 3/11; 4/2

PEDESTRIAN SAFETY

National Safety Council.

[1970] 10p 19 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support for state highway safety programs on pedestrian safety. Those most often involved in pedestrian accidents are the young, the elderly, and those under the influence of alcohol. The standard requires each state to develop and implement a program to

release and a pattern public service announcement are included.

Search terms: Highway safety programs; Highway safety standards; Pedestrian safety; Pedestrian accidents; Pedestrian behavior; Pedestrian characteristics; Safety propaganda; Community support

HS-009 715 Fld. 3/11

SELECTED BIBLIOGRAPHY ON TRAFFIC CONTROL FOR PEDESTRIAN SAFETY

by Donald E. Cleveland

Michigan Univ. Hwy. Safety Res. Inst.

Jun 1969 73p 539 refs

Prepared in cooperation with the Michigan Dept. of State Police and the National Highway Safety Bureau.

This selected bibliography, relating the effects of various types of traffic engineering and control techniques to pedestrian safety, has been prepared as part of the work program of the Highway Safety Research Institute of the University of Michigan, in support of Detroit's Pedestrian Safety Demonstration Project being conducted in accordance with Section 402 of the Highway Safety Act of 1966, administered by the National Highway Safety Bureau and authorized by the Highway Safety Planning Division of the Department of State Police of the State of Michigan. The bibliography is based on a comprehensive review of all available literature through December 1968.

Search terms: Bibliographies; Pedestrian safety; Pedestrian crossings; Pedestrian accidents; Pedestrian control; School crossing protection; Traffic control; Pedestrian characteristics; Pedestrian control signals

3/12 Vision (Cont'd.)

HS-009 716 (Cont'd.)

VISION SCREENING FOR DRIVER LICENSING

American Optometric Assoc.; American Assoc. of Motor Vehicle Administrators

1970 35p

This is a revision of a manual first prepared in 1949 as a joint effort of the Motorist Vision and Highway Committee of the American Optometrist Association and the American Association of Motor Vehicle Administrators. It is intended to assist the license examiner who is required to screen the visual abilities of applicants for driver's license. It covers: (1) vision and the driving task; (2) how to administer a vision screening program; (3) how to conduct vision screening; (4) AAMVA vision standards; and (5) role of the vision specialist.

Search terms: Driver vision standards; Vision tests; Vision disorders; Vision age changes; Eyeglasses; Driver license manuals; Driver license examination; Driving tasks

AVAILABILITY: American Optometric Assoc.

4/9 OTHER SAFETY-RELATED AREAS

4/1 Codes and Laws

HS-009 717 Fld. 4/1; 4/2

CODES AND LAWS

National Safety Council.

[1970] 7p 8 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

promoting public support for state highway safety programs on codes and laws. The historical background of work toward a uniform traffic law system is summarized, the requirements of the standard are stated, the rationale for uniform codes and laws is given, and a few arguments and their answers shown. A pattern newspaper release and a pattern public service announcement are included.

Search terms: Traffic laws; Highway safety programs; Uniform Vehicle Code; Law uniformity; State laws; Safety propaganda; Community support

4/6 Insurance

HS-009 718 Fld. 4/6

THE CONSUMER SPEAKS OUT ON AUTO INSURANCE

Anonymous

Published in *Journal of American Insurance* v46 n4 p25-8 (Sep-Oct 1970)

Two nationwide opinion polls have been taken on consumer attitudes toward accidents and compensation therefor, both for car damage and for bodily injury. Results showed that car owners have a surprisingly clear idea of what is driving insurance costs up. Both polls also surveyed consumer attitudes on various proposals to change auto insurance coverage, including two types of "no fault" insurance, and reimbursement for "pain and suffering."

Search terms: Insurance costs; Insurance claims; No fault insurance plan; Injury compensation; Accident compensation; Insurance rates; Damage costs; Injury costs; Consumer attitudes; Opinion polls

HS-009 719 Fld. 4/6

STEREO GOES MOBILE

Published in *Journal of American Insurance* v46 n4 p13-5 (Sep-Oct 1970)

The automobile insurance industry has proposed an optional endorsement to cover theft or accidental loss of stereo tapes from automobile but limits coverage to \$200 for a single loss. Stereo players will continue to be covered under existing auto insurance policies although the language of the policy may need to be clarified. Insurance companies are paying an estimated \$40 million a year on claims for theft and damage to auto stereo equipment and tapes, and there has been confusion about coverage for them.

Search terms: Insurance claims; Theft; Tape recordings; Music; Insurance rates

HS-009 720 Fld. 4/6

THE FAULT OF NO-FAULT

by Charles Hvass; P. L. Pellegrini

Published in *State Government* v43 n3 p153-8 (Summer 1970)

This article describes the drawbacks of three no-fault insurance plans: the American Insurance Association plan, the New York Plan, and the Davies Plan. Under all other existing insurance plans today, the injured party does not give up his right to recover against the negligent party for his loss but under the no-fault insurance plan, the injured party, no matter how great his financial loss, is required to bear the entire loss himself. Examples of this kind of situation are given and a critique is made of the claims of no-fault plans. A list of recommendations is given to bring insurance laws up-to-date.

Search terms: No fault insurance plan; Insurance costs; Injury compensation; Liability insurance; Insurance laws

HS-009 721 Fld. 4/7

STANDARD ELECTRONIC UNITS INTERCONNECT TO PROVIDE FLEXIBLE DIGITAL RECORDING

by Richard C. Hopkins

Published in *Highway Research Board Bulletin* n261 p44-9 (1960)

Presented at the 39th annual meeting of the Highway Res. Board, 11-15 Jan 1960.

Standard electronic units which may be combined to form flexible digital recording systems for recording time and weight measurements, vibration or dynamic strain, liquid levels or large displacements, deflections or small displacements, shaft speeds, and temperature are described, and block diagrams provided. An example of several data being simultaneously entered on a digital recorder is provided in the Traffic Impedance Analyzer developed by the Bureau of Public Roads for speed and delay or operating economy studies. The operation of this equipment is explained.

Search terms: Digital computers; Recorders; Traffic analyzers; Test equipment

4/8 Transportation Systems

HS-009 722 Fld. 4/8

THE CENTER FOR TRANSPORTATION STUDIES. ANNUAL REPORT. APRIL 1969 TO MARCH 1970.

Manitoba Univ. (Canada)

Aug 1970 44p 12 refs
Report no. RR-7

Research activities; teaching activities

tion on the organizational structure of the center, financial summary, involvement of Univ. of Manitoba staff, individual research programs, courses offered in transportation, graduate students working on theses in transportation, publications of the center, the program for a May 1970 Conference on Transportation and Regional Development, and a summary of the next year's research program.

Search terms: Canada; Research facilities; Transportation studies; Annual reports

HS-009 723 Fld. 4/8

AUTOMOBILE FACTS AND FIGURES

Automobile Manufacturers Assoc., Inc.

1964 75p

Statistics are given about the production of trucks, buses, and passenger cars; domestic and foreign factory sales; special motor vehicle types; new motor vehicle registration by state; automobile ownership in the European Common Market and Great Britain; world motor vehicle registration; U. S. motor vehicle exports by countries; world motor vehicle production trends; scrapped vehicles; vehicle age; automobile ownership; vehicle mileage; vehicle taxation; economic importance of transportation.

Search terms: Highway transportation; Automotive industry; Highway economic factors; Economic analysis; Vehicle registration; Exports; Taxation; Vehicle mileage; Foreign trade; Highway taxation; Automobile production statistics; Transportation statistics; Automobile scrap statistics; Vehicle age; Europe; Great Britain; International factors; Automobile ownership; Buses; Trucks

TOMS RAPS ROAD TOLL. SAFETY DIRECTOR PLEDGES TOUGH MOVES

by Joseph M. Callahan

Published in *Automotive Industries* v143 n3 p20-2 (1 Aug 1970)

Douglas C. Toms, Director of the National Highway Safety Bureau, outlines the steps to be taken by his agency to reduce the levels of traffic fatalities. He cites major priorities: passive restraints, alcohol countermeasures. Other features discussed are radar brake systems, anti-skid systems, bumper standards.

Search terms: Drinking drivers; Passive restraint systems; Alcohol usage deterrents; Bumper standards; Brake systems; Radar; Antiskid devices; Air bag restraint systems; Alcohol detection and interlock systems; Vehicle safety

5/1 Brake Systems

HS-009 725 Fld. 5/1; 3/12; 5/10

AVAILABLE BRAKING DISTANCES IN NIGHT DRIVING

by Gunnar Johansson; Kare Rumar

Uppsala Univ. (Sweden)

Nov 1963 15p 4 refs
Report no. 13

In Sweden, an attempt has been made to obtain absolute values of available braking distances for different conditions of car lighting and object and road reflectances. The reaction time of a driver can be translated into a reaction distance depending on the speed of the car. The available braking distance is obtained by subtracting the reaction distance from the critical distance. Braking distance

5/1 Brake Systems (Cont'd.)

HS-009 725 (Cont'd.)

pedestrians and cyclists must wear some form of reflector or lamp in order to increase their detectability, preferably both.

Search terms: Sweden; Braking distances; Night driving; Night visibility; Driver reaction time; Vehicle lighting; Pedestrian visibility; Sight distances; Oncoming vehicles; Low beamed headlamps; Headlamp usage

5/3 Cycles

HS-009 726 Fld. 5/3; 4/2

MOTORCYCLE SAFETY

National Safety Council

[1970] 8p 9 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support of state highway safety programs having to do with motorcycles. The increase in popularity of motorcycles has brought a corresponding increase in motorcycle accidents. Studies pinpoint the untrained operator as the major cause of accidents, and head protection as the best means of reducing deaths and serious injuries. The high motorcycle death rate of 22 per 100,000,000 miles driven (as against 5.3 for motor vehicles) and the high injury rate have prompted many states to adopt laws protecting cyclists. These include: operator licensing laws; compulsory wearing of protective headgear; requiring various items of safety equipment on the cycle; and operating only with the headlamps on. A pattern newspaper release and a pattern public service announce-

laws; Helmets; State laws; Safety propaganda; Community support; Motorcycle operator experience; Motorcycle accidents; Highway safety programs

HS-009 727 Fld. 5/3

LILLIPUT-PUTTS

Anonymous

Published in *Air Force Driver* v4 n2 p14-19 (Jul 1970)

Minibikes are often thought of as toys for children to operate, but a group of experienced motorcyclists have proven them to be difficult to handle and hazardous to operate on the street. Difficulty in climbing hills was experienced, primarily because the weight of a full-grown man, placed over the rear wheel, sometimes caused the machine to try to rotate about the rear wheel. In addition, minibikes are difficult for other traffic to see. For this reason and because they are not equipped with required safety features, minibikes are not legal for street operation in most states.

Search terms: Road tests; Minibikes; Vehicle stability

5/4 Design

HS-009 728 Fld. 5/4; 5/18

A SYSTEM FOR AUTOMATIC VEHICLE LATERAL GUIDANCE

by Karl W. Olson; Eugene R. Sapp; Terrance L. Flaig

Ohio State Univ.

Published in *Highway Research Record* n275 p1-11 (1969)

5 refs

Substantial savings in both lives and personal property can be achieved through highway automation. The experimental results obtained from one phase of an automation study—automatic lateral guidance—are presented in this paper. A system has been designed and experimentally tested at speeds up to 70 mph on both steel-reinforced roads and non-reinforced roads. The severe problems produced by the steel reinforcing materials in the road have been isolated. Preliminary test results indicate that the proposed system is feasible on non-reinforced roads. Work is continuing on eliminating the adverse effects of reinforcing materials.

Search terms: Automatic steering control; Guidance systems; Lateral vehicle spacing; Reinforced roads; Road tests; Automatic highways; Sensors

HS-009 729 Fld. 5/4

MATERIAL CONSIDERATIONS FOR AUTOMOBILE CAMSHAFTS

by M. P. Jarrett

G. K. N. Forgings and Castings Ltd. (England)

1971 4p 3 refs
Report no. SAE-710545

Presented at SAE mid-year meeting, Montreal, 7-11 Jun 1971.

A variety of materials is currently specified for automobile camshafts. The choice depends on a number of factors, with resistance to surface deterioration the most important. Published research suggests that satisfactory operation of a material depends not only upon the operating conditions of stress, velocity, and lubrication, but also upon the follower material and possibly upon the shape of cam. Analysis of available evidence, augmented by additional material

where stresses are moderate, and concessions can be made to economy.

Search terms: Camshafts; Materials tests; Wear resistance; Stress (mechanics); Cast iron

AVAILABILITY: SAE

HS-009 730 Fld. 5/4; 4/5

THE PRACTICAL APPLICATION OF COMPUTERS TO THE DESIGN OF BEARING IN AUTOMOTIVE ENGINES

by R. H. Spikes; J. P. Pirault

Vandervell Products Ltd. (England)

1971 8p 17 refs
Report no. SAE-710548

Presented at SAE mid-year meeting, Montreal, 7-11 Jun 1971.

This paper describes how, with the use of computer aided techniques, the various factors involved in the bottom end design of automotive piston engines are developed. In the study of the behavior of oil film in a journal bearing, the problem has been to determine what simplifying assumptions were valid in order to present useful information at a low enough cost. Discussed in some detail are possible lubrication systems, material specifications, and hydrodynamic performance of the bottom end design of engines. With the use of correct simplifying assumptions, simple computer programs, and visual presentation, good use can be made of the available theory to aid the engine designer.

Search terms: Computerized design; Engine design; Lubrication systems; Journal bearings; Lubricating oils; Hydrodynamics; Bearing materials; Engine balancing

AVAILABILITY: SAE

MENT STATUS OF THE STRATIFIED CHARGE ROTATING COMBUSTION ENGINE

by Charles Jones; Harold Lamping

Curtiss-Wright Corp.

1971 21p 19 refs
Report no. SAE-710582

Presented at SAE mid-year meeting, Montreal, 7-11 Jun 1971.

The paper covers exploratory development of the rotating combustion (RC) engine spark ignited stratified charge versions since 1966. Configuration improvements resulting in increased power and reduced fuel consumption are described and test results cited. Exhaust emissions are presented, with and without a catalytic converter, and compared with carbureted RC engine results as well as limited diesel engine data. It is concluded that the technical bases for an efficient, lightweight, economic, low-emission power-plant capable of broad range operation have been demonstrated. Weight and displacement parametric curves are presented for one family of advanced higher speed engines.

Search terms: Stratified charge engines; Diesel engines; Fuel consumption; Spark ignition engines; Exhaust emission tests; Diesel engine exhaust emissions; Fuel injection; Air fuel ratio; Ignition systems; Engine speeds; Hydrocarbons; Nitrogen oxides

AVAILABILITY: SAE

HS-009 732 Fld. 5/4

FRAME STRESS ANALYSIS WITH PROGRAMMED LOAD WHEEL INPUTS VIA PLASTIC MODELS

by J. W. Van Dorn; G. L. Goldberg

Presented at the SAE mid-year meeting, Montreal, 7-11 Jun 1971.

The paper discusses the stress analysis of a plastic model passenger car frame using road forces recorded on an actual vehicle. This test vehicle was instrumented to record suspension member forces and then driven over various durability routes. These suspension forces were then analyzed for instantaneous peaks, which were input statically to the plastic model chassis. The model frame was stresscoated and strain gaged to determine stress levels for the various road profiles and vehicle maneuvers considered. The procedure for the actual construction of the plastic model and its environmental test fixture is explained in detail. The paper illustrates the ability to use plastic models as a design tool to provide feedback to the engineer. The information obtained in the test was not only useful in locating potential structural problems, but it also helped in evaluating manufacturing and ride development changes for design feasibility and cost efficiency.

Search terms: Scale models; Strain (mechanics); Stress (mechanics); Plastics; Structural analysis; Chassis design; Bending; Torsion; Frame tests; Loads (forces); Suspension systems; Laboratory tests; Stress analysis

AVAILABILITY: SAE

HS-009 733 Fld. 5/4

AN EVALUATION OF THE FATIGUE PERFORMANCE OF AUTOMOTIVE STEELS

by P. Watson; T. H. Topper

Waterloo Univ. (Canada)

1971 11p 21 refs
Report no. SAE-710597

Presented at the SAE mid-year meet-

5/4 Design (Cont'd.)

HS-009 733 (Cont'd.)

steels used in the automotive industry is presented. This evaluation ranges from the endurance limit through the transition life and low cycle regions to the monotonic results. Smooth and notched specimens, tested in strain control and load control, respectively, provide data that are used to indicate notch sensitivity and size effects, cyclic strength and ductility, and cyclic deformation response. The effect of overloads on fatigue damage is given and prestrained smooth specimens demonstrate the possible effect of a few large plastic strain cycles on fatigue resistance. Overloaded notched specimens indicate reductions in life due to both large plastic strain cycles and the induced tensile residual stress. These data are suitable for direct insertion into the design process and also provide a broad base for continuing studies of cyclic behavior.

Search terms: Steels; Fatigue (materials); Notch sensitivity; Alloys; Materials tests; Laboratory tests

AVAILABILITY: SAE

HS-009 734 Fld. 5/4

DRIVE TO MAKE AUTOS SAFER — WHAT THE GOVERNMENT WANTS

Anonymous

Published in *U. S. News and World Report* v69 n9 p35-6 (31 Aug 1970)

The planned motor vehicle safety stand-

standards; Automotive industry; Automobile safety characteristics; Alcohol detection and interlock systems; Crashworthiness; Occupant protection; Lead time; Air bag restraint systems; Safety design

5/6 Fuel Systems

ERRATUM

In issue HSL No. 71-22 dated August 13, 1971 on page 14 the following appeared:

HS-009 534 Fld. 5/6

WHICH GAS SHOULD I USE?

by Arthur Perrow

Published in *Motor Trend* v22 n7 p8-9, p62, 64 (Nov 1970)

SHOULD HAVE READ:

Published in *Motor* (New York) v134 n5 p62, 64 (Nov 1970)

HS-009 735 Fld. 5/6

MEASURING THE TRAPPING EFFICIENCY OF INTERNAL COMBUSTION ENGINES THROUGH CONTINUOUS EX- HAUST GAS ANALYSIS

by E. W. Huber

veniently the effective cylinder charge in an internal combustion engine through a continuous exhaust gas analysis is described. For gasoline engines, the oxygen content of the exhaust gas is monitored and for diesel engines, n-butane is used as a tracer gas. The method can be used on 2-stroke and 4-stroke cycle engines. The theoretical basis of the method is discussed and the limits of the application are shown. Actual test results obtained with test engines, which were especially prepared for zero scavenging and for controlled scavenging with air only or with an air/fuel mixture, are quoted.

Search terms: Radioactive tracers; Scavenging; Internal combustion engines; Diesel engines; Cylinder pressure; Laboratory tests; Exhaust gases; Oxygen detectors; Butane; Air fuel ratio; Engine operating conditions

AVAILABILITY: SAE

HS-009 736 Fld. 5/6; 4/5

DIESEL FUEL INJECTION SYSTEM SIMULATION AND EXPERIMENTAL CORRELA- TION

by E. Benjamin Wylie; Jay A. Bolt; Mohamed F. El-Erian

Michigan Univ.

1971 15p 18 refs
Report no. SAE-710569

Presented at SAE mid-year meeting, Montreal, 7-11 Jun 1971.

A theoretical digital simulation of a conventional diesel fuel injection system

important factors that affect the accuracy of the simulation model. These include the effect of pressure on the fuel bulk modulus and wave speed, the pipe line residual pressure, and the coefficient of discharge of important orifices.

Search terms: Diesel engines; Fuel injection; Computerized simulation; Orifice flow; Simulation models; Pressure waves; Cavitation; Friction; Engine speeds; Fuel flow; Fuel pumps

AVAILABILITY: SAE

HS-009 737 Fld. 5/6; 4/5; 4/7

SIMULATION OF THE CUMMINS DIESEL INJECTION SYSTEM

by Andrew Rosselli; Pat Badgley

Cummins Engine Co., Inc.

1971 12p
Report no. SAE-710570

Presented at SAE mid-year meeting, Montreal, 7-11 Jun 1971.

Analogue and digital simulation of the Cummins unit diesel injector have been developed. The mathematical models are derived and the computer results compared with experimental data. The simulations are used to investigate critical aspects of injector behavior.

Search terms: Fuel injection; Mathematical models; Computerized simulation; Diesel engines

AVAILABILITY: SAE

HS-009 738 Fld. 5/6

A BASIS FOR THE COMPARISON OF VARIOUS EXPERIMENTAL METHODS FOR STUDYING SPRAY PENETRATION

1971 5p 9 refs
Report no. SAE-710571

Presented at SAE mid-year meeting, Montreal, 7-11 Jun 1971.

A basis for the comparison of engine spray penetration studies with hot and cold bomb methods, and the liquid injection technique for studying penetration is presented. A spray penetration formula is developed from experimental information on gas jet mixing, with a correction for fuel density. Agreement between the spray penetration formula developed here and experimental data from a variety of sources is found to exist.

Search terms: Fuel injection; Fuel spray; Engine operating conditions; Mathematical models; Gas motion; Orifice flow

AVAILABILITY: SAE

HS-009 739 Fld. 5/6; 4/7

CALCULATION AND MEASURING OF PISTON TEMPERATURES OF AIR-COOLED TWO-STROKE GASOLINE ENGINES

by Otto Kruggel

Motoren- und Turbinen-Union
Friedrichshafen GmbH

1971 18p 12 refs
Report no. SAE-710578

Presented at SAE mid-year meeting, Montreal, 7-11 Jun 1971.

For a geometrically simplified piston model, temperatures in the crown center and at the first ring groove as well as the rotationally symmetrical temperature fields of the crown were first calculated according to the equation of Gintsburg with the assumption of constant temperatures and conditions of heat

continuously by means of thermocouples located at 36 measuring points in the piston and 12 measuring points at the cylinder of a test engine of 80 mm (3.15 in) bore up to an engine speed of $n=2800$ rpm. In this way the agreement between the calculated and the experimental results could be checked.

Search terms: Air cooled engines; Two stroke cycle engines; Temperature; Heat transfer; Pistons; Mathematical models; Mathematical analysis; Heat resistance; Exhaust gases; Cylinders

AVAILABILITY: SAE

HS-009 740 Fld. 5/6; 4/7

SCAVENGING MODEL SOLVES PROBLEMS IN GAS BURNING ENGINE

by Nabi Dedeoglu

Sulzer Brothers Ltd. (Switzerland)

1971 12p 8 refs
Report no. SAE-710579

Presented at SAE mid-year meeting, Montreal, 7-11 Jun 1971.

An application of model tests based on laws of similarity is developed in this paper for the analysis of the scavenging and gaseous mixing process in gas-burning engines. Systematic tests disclosed that only the Strouhal model law and the density ratio between the substances involved (Euler's similarity law) are significant. It is also pointed out that fluids are particularly convenient for examination of the scavenging and mixing processes (simple quantitative measurement, and ease of visualization). The model tests deliver qualitative and quantitative predictions on scavenging and mixture formation in the actual engine.

5/6 Fuel Systems (Cont'd.)

HS-009742 (Cont'd.)

mixtures; Fluid flow; Air fuel ratio; Exhaust gases

AVAILABILITY: SAE

HS-009 741 Fld. 5/6

STUDY OF NON-UTILITY LNG MARKETS. FINAL REPORT

by R. B. Foster; P. A. Ketels

Institute of Gas Technology

May 1970 51p 4 refs

The characteristics of liquified natural gas as a fuel for cars and trucks are discussed. Its low exhaust emissions of carbon monoxide, hydrocarbons, and oxides of nitrogen are described. The economics of its use as a fuel, developments in engine design which would make its use possible, and its applications in other industries are discussed.

Search terms: Liquified natural gas; Exhaust emissions; Hydrocarbons; Carbon monoxide; Nitrogen oxides; Fuel costs; Engine design

HS-009 742 Fld. 5/6

NEW APPLICATIONS FOR LNG

by Robert E. Petsinger

LNG Services

Published in *Proceedings of the International Conference on Liquefied Natural Gas*, London, 1969, p.75-88.

immediate markets for LNG, including various transportation applications, standby fuels for community and industry, and future innovations. Transportation applications include: over-the-road equipment such as automobiles, taxicabs, buses, and trucks; off-the-road units such as trucks, scrapers, and other earth-moving equipment; railroad locomotives for rapid transit; marine transportation systems; and aircraft and helicopter fuel. The portability of LNG lends itself to base load supply to outlying communities and temporary fuel for service line interruptions. LNG fueled standby electric power generation, desalinization of water, and magnetohydrodynamic generation of electricity are also discussed.

Search terms: Liquified natural gas; Natural gas vehicles; Dual fuel vehicles; Exhaust emissions; Natural gas automobiles; Air pollution control; Fuels

HS-009 743 Fld. 5/6

KNOCK. FIVE ENGINE ASSASSINS

by Charles Goodacre

Published in *Autocar* v134 n3905 p2-5 (28 Jan 1971)

Problems arise when lead-free gasoline is used. The reason for taking the lead out of gasoline is to prevent it clogging the catalytic afterburners which are supposed to bring exhaust emissions down to the prescribed limits. The effect on the combustion process of removing lead additives is to encourage preignition. The ways in which preignition can occur are discussed. If there is a need for reducing exhaust

Gasoline quality; Internal combustion engines

HS-009 744 Fld. 5/6

WILL THE NEW GASOLINES LICK AUTO POLLUTION?

Anonymous

Published in *Consumers Report* v36 n3 p156-9 (Mar 1971)

The effectiveness of lead-free gasoline in reducing the air pollution attributed to automobile exhaust emissions is discussed. Costs of the new unleaded gasolines are compared with the current premium gasolines. Air pollution as a health hazard is discussed.

Search terms: Air pollution emission factors; Lead free gasoline; Exhaust emissions; Vehicle air pollution; Air pollution effect on health; Air pollutants; Health hazards; Fuel costs

HS-009 745 Fld. 5/6; 5/15

TRYING NEW FUELS

by Jack Steele

Published in *Fleet Owner* v66 n2 p67-70, 147-9, 173 (Feb 1971)

Although gas is a readily available substitute for gasoline, and can be used in existing internal combustion engines with only minor modifications, few fleet owners have taken more than a token step toward making the switch. As a result very little real high mileage experience exists. The experience of several Southern California fleets with gas in converted engines and in dual fuel vehicles is discussed. The leading advantages

HS-009 746 Fld. 5/6

AUTOMOTIVE POLLUTION: A DISCUSSION WITH GM'S PRESIDENT COLE

by C. W. Borklund

Published in *Government Executive* v2 n9 p80, 82-3 (Sep 1970)

General Motors predicts an essentially pollution-free internal combustion engine in all its automobiles by 1974. Conditions required to meet these objectives include lead-free fuels and uniform emission standards. Steam, electrical, and gas turbine power alternates will not provide the answer without significant technological advances. Some questions are raised as to whether pollution-free 1974 models will solve the air pollution problem, unless older cars are modified to provide some sort of emission control, and whether the automobile is really the major cause of air pollution.

Search terms: Air pollution emission factors; Internal combustion engines; Lead free gasoline; Vehicle air pollution; Gas turbine engines; Steam engines; Electric automobiles; Emission standards; Exhaust emission control devices

5/9 Inspection

HS-009 747 Fld. 5/9; 4/2

PERIODIC MOTOR VEHICLE INSPECTION

National Safety Council.

[1970] 13p 9 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet is intended for use in promoting public support for state high-

vehicle inspection program is to decrease the number of vehicle defects that cause or contribute to accidents. Today, 31 states and the District of Columbia provide for inspection of all motor vehicles by statute. There are four basic types of motor vehicle inspection systems: state owned and operated stations; state appointed stations; combination systems; and random spot checking of vehicles. The advantages and disadvantages of each type are given. A pattern newspaper release and a pattern public service announcement are included.

Search terms: Vehicle inspection; Inspection stations; Inspection laws; Inspection effectiveness; Safety propaganda; Defective vehicles; State laws; Highway safety programs; Fatality rates; Community support

5/10 Lighting Systems

HS-009 748 Fld. 5/10

DAYTIME RUNNING LIGHTS

by L. Ellis King; D. M. Finch

West Virginia Univ.; California Univ. ITTE

Published in *Highway Research Record* n275 p23-31 (1969)

3 refs

Sponsored by Committee on Visibility and presented at Highway Research Board 48th annual meeting.

The accident rate and total number of accidents involving motor vehicles in daytime has reached alarming proportions. A lighting device, in the form of a daytime running light, may be effective in reducing the number of accidents by increasing the daytime visibility of vehicles in the driver's field of view. The primary objective of this investigation was to examine the idea that running lights on motor vehicles would substan-

study was divided into three investigations of the levels of luminance encountered under roadway conditions; (b) measurements of vehicles signalized intersection; and (c) evaluations of simulated runs under static test conditions. Combined results of the indicate that the daytime vehicle can be improved by of a running light of approx 2,000 candlepower and a luminous area of 20 sq. in.

Search terms: Vehicle visibility; Time of day lamp daytime usage; Brightness; Contrast; colors

5/15 Propulsion Systems

HS-009 749 Fld. 5/15

LEAR: THE STEAM KIN

by Karl Ludvigsen

Published in *Motor Trend* v2 34-5, 83 (Feb 1971)

The research conducted by Corp. on substitutes for combustion engine is reviewed currently under way is Developments of steam vapordyne power systems, turbines are discussed. Modern engines of several autom are described. The low emissions of these propulsion systems

Search terms: Steam Experimental engine emissions; Vapor engines; Turbines; Engine modification

HS-009 750 Fld. 5/15

NEW: MINTO'S UNIQUE LESS "STEAM" CAR

5/15 Propulsion Systems (Cont'd.)

HS-009 750 (Cont'd.)

Published in *Popular Science* v197 n4
p51-3, 130 (Oct 1970)

The design of the Datsun station wagon equipped with the Minto freon engine is described. It is driven by expanding fluorocarbon and results in no lead emissions, no measurable oxides of nitrogen, and virtually no carbon monoxide. Fuel consumption should be about the same as with an internal combustion engine. Two additional advantages of this car are expected: a price 10-20% lower than with the present engine, and better handling due to a lower center of gravity. Safety characteristics are described.

Search terms: Freon engines; Minto freon automobiles; Japanese vehicles; Vehicle handling; Automobile prices; Automobile safety characteristics; Engine design; Engine operating conditions

5/16 Registration

HS-009 751 Fld. 5/16; 4/2

MOTOR VEHICLE REGISTRATION

National Safety Council.

[1970] 7p 10 refs

Included in the Safety through Action to Enlist Support (STATES) program publicity kit.

This fact sheet, giving the background, requirements, and rationale of a motor vehicle registration program, is intended for use in promoting public support of state highway safety programs. The need for quick accurate identification of the

and research; accident investigation; planning and development of streets, highways, and related facilities; law enforcement; and other operational uses. A pattern newspaper release and a pattern public service announcement are included.

Search terms: Vehicle registration; Safety propaganda; Stolen vehicles; Highway safety programs; State laws; Automobile identification; Community support

5/20 Trucks and Trailers

HS-009 752 Fld. 5/20; 5/11

MISSION POSSIBLE — SELECTING UTILITY TRUCK PACKAGE

by D. H. Groft; Albert E. Reske; George H. Eckels

Chance (A. B.) Co.; Tel-E-Lect, Inc.; Pitman Mfg. Co.

1971 22p
Report no. SAE-710239

Presented at Automotive Engineering Congress 11-15 Jan 1971.

New equipment and devices are being introduced to the utility field each year. New people enter the ranks of management to make the decisions for equipment selection. This presentation is intended to assist the experienced equipment people and also help the less experienced to select the proper utility truck package to perform the right job function. Each part of equipment selection is presented and analyzed. This includes device, body, payload, chassis, stability, economics, rules and regulations, operator training, and maintenance.

Search terms: Truck modifications;

Truck maintenance; Loads (forces)

AVAILABILITY: SAE

5/22 Wheel Systems

HS-009 753 Fld. 5/22

POWER LOSS TESTING OF PASSENGER TIRES

by C. W. Floyd

Firestone Tire and Rubber Co.

1971 8p
Report no. SAE-710576

Presented at SAE mid-year meeting Montreal, 7-11 Jun 1971.

Laboratory power loss test procedure and effect of varying conditions of power loss is discussed. An attempt made to correlate laboratory rolling resistance with fuel economy. This information is presented from the perspective of a tire engineer, with the objective of providing useful information to automotive designers as well as other parties.

Search terms: Tire rolling resistance; Power loss; Laboratory tests; Fuel economy

AVAILABILITY: SAE

HS-009 754 Fld. 5/22

TIRE USE SURVEY. THE PHYSICAL CONDITION, USE, AND PERFORMANCE OF PASSENGER CAR TIRES IN THE UNITED STATES OF AMERICA

by J. L. Harvey; F. C. Brenner

National Bureau of Standards

Mar 1970 62p 21 refs

car tires are reported. Some conclusions are drawn concerning the physical condition, use, and abuse of passenger car tires in service during these years, particularly with regard to tread depth, inflation pressures, and degree of overloading. The various estimates of tire disablement rates are compared, and contribution of tires to motor vehicle accidents explored. Recommendations are made, directed toward upgrading the level of quality of passenger car tires in service, and reducing their abuse, with the hope and expectation that service performance will be improved, and contributions of tires to highway accidents reduced.

Search terms: Tire loads; Tire failures; Tire performance; Tire inflation pressure; Tire tread depths; Tire wear; Tire maintenance; Tire wear measurement; Tire defects; Tire failure caused accidents; Tire quality

AVAILABILITY: GPO \$0.60

5/23 Windshield-Related Systems

HS-009 755 Fld. 5/23

ELECTRONIC WIPER TIMING DEVICES

by Helmut G. Seidler

Philco-Ford Corp.

1971 9p
Report no. SAE-710260

Presented at Automotive Engineering Congress, Detroit, 11-15 Jan 1971.

Under certain conditions, such as light rain, heavy fog, or back spray from other vehicles on wet roads, the windshield wipers may cause smearing of the windshield. This is due to a wet-dry condition of the windshield where insufficient moisture is available for continuous wiping. To overcome this, it is desirable to provide intermittent operation where the wiper blade dwells for an interval time before starting the next cycle. This dwell period may be accomplished by electrical or mechanical means. This paper discusses the various approaches with special emphasis on the electronic wiper timing devices.

Search terms: Windshield wipers; Windshield wiper design; Electronic devices in vehicles; Windshield wiper blades; Timing

AVAILABILITY: SAE

NHTSA DOCUMENTS

NHTSA Contractor Reports

HS-800 516 Fld. 5/4; 3/3; 3/11; 1/5

RESEARCH IN IMPACT PROTECTION FOR PEDESTRIANS AND CYCLISTS. FINAL REPORT

by Paul M. Culkowski; John M. Keryeski; R. Paul Mason; William C. Schotz; David J. Segal

Cornell Aeronautical Lab., Inc.

May 1971 354p 16 refs
Contract FH-11-6955
Report no. CAL-VJ-2672-V-2

Report for Jun 1968 - May 1971.

This report presents the results of research related to automobile design features for protection of pedestrian and cyclists in collision. The reported research program had the objective of developing, and of providing substantiating evidence to support, performance requirements for automobiles that will enhance the protection of pedestrians and cyclists. The three-part research effort included: a pedestrian, cycle, and motorcycle accident study of 319 accidents in the Toronto area; the development and application of a computer simulation of the dynamics of pedestrian impacts; and an exploratory experimental study of impact loadings and structural deformations related to pedestrian impacts with automobile exteriors.

Search terms: Impact protection; Pedestrian injuries; Bicycle rider injuries; Vehicle pedestrian collisions; Vehicle motorcycle collisions; Safety design; Human body kinematics; Injury severity; Impact tests; Computerized simulation; Side impact collisions; Injuries by body area; Pedestrian vehicle interface; Injuries by age; Motorcycle operator injuries; Injury causes; Body design; Structural deformation analysis; Impact forces; Vehicle bicycle collisions; Front end collisions; Accident simulation



executive summary

SYNOPSIS OF A RECENTLY RELEASED NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION RESEARCH REPORT

TIRE REPAIR METHODS AND MATERIALS

The objective of this study is to assess the safety adequacy of tire repair methods and materials as accomplished by various repair and maintenance facilities.

Contract FH-11-7196
Retreading Research Associates, Inc.
6819 Tennyson Drive
P. O. Box 387
McLean, Virginia 22101
DOT/HS-800 372 PB-196 952

Award Amount: \$30,027.00
Report Due: 9-30-70
Report Rec'd: 1-27-71

METHODOLOGY

The study consisted of three phases: The initial phase of the study entailed the personal contact of one thousand seven hundred thirty-two field service facilities that had the potential of doing repairs on passenger tires. Of that number, three hundred eighty-five or twenty-two point two percent did no repairing, while eight hundred ninety-seven (66.6%) Gasoline Refuel Stations did repairing along with two hundred twenty-five (16.7%) Automobile Repair Garages, ninety-five (7.1%) New Automobile Dealers, eighty-five (6.3%) Used Automobile Dealers, forty (3.0%) Tire Dealers, and five (.4%) Tire Dealers and Retreaders. While only three percent of the Tire Dealers and Retreaders were related with the total, it can be assumed, since the study did not involve the quantitative factors of each facility, that a much greater percentage of the business was actually done by them.

The majority of available brands of repair materials, currently on the market, were included in the study. Approximately eighty tires were actually repaired by the representative field service facilities and ninety-three tests were performed on the Retreading Research Associates Static Air Loss Tester. The results

Patch-Plugs and Patches passed except one failure. Of the total number of tests, forty-seven percent of the repairs were failures.

The second phase of the study involved the repairing of ninety-nine used tires that were tested according to FMVSS109 procedures. Both the endurance and high speed tests were used to evaluate the repairs. The results of these tests were quite different from the static tests; Patch-Plugs and Patches failed most rapidly, Molded Plugs and Strip Repairs were in between, with String repairs all passing. It must be remembered at this point, that all of the repairs were made by experienced tire people, under laboratory conditions and that an occasional leaker was found and corrected before the tires were placed on test. Even with these conditions, the failure rate was thirty-seven percent.

The final phase of the study involved the repairing of twenty used tires with multiple repairs. The tires were tested on the highway under high stress, load and inflation conditions. The initial test pressure was twenty psi, gradually reduced to fourteen psi. for the completion of each test. Again, it must be remembered that all repairs were made by experienced tire people under laboratory conditions. With the

RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

It appears that when the repairs are performed correctly for a known form of injury, (RRA used a 1/4 inch triangular file pulled straight through the center area of tread) that all repair materials are satisfactory. The key to repairing tires is to know the size, angle and shape of the injury and know what the limits are for each type of repair material being used. The decision for repairing tires from the outside or dismounting the tire and repairing from the inside, must be made based on those three factors.

- Road tests are recommended as the most satisfactory means of testing repaired tires. This is obvious when we consider that indoor wheel testing done in compliance with FMVSS109 was completed with a thirty-seven percent failure rate. The inverted tire tread footprint against the radius of the test wheel causes unnatural stress-strain between the repair and the tire.
- This is further supported when we consider the twenty road tested tires having a total of forty-one repairs and only failure which was traced to an error in patch application. Repair methods and

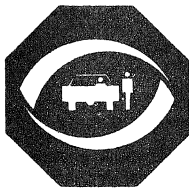
materials were generally the same in both the indoor wheel test and the highway road test.

- Repair materials should be dated along with normal shelf life because all uncured rubber and adhesives have a shelf life expectancy. Overage materials will cause repair failures.
- Poor preparation and application was found to be a major cause of tire repair failures. Some way should be found to train field service facility repairmen to include a certification or guarantee, that the work has been performed to the same quality standards that the repair manufacturers now require in their package instructions.

The Contract Technical Manager has certified that the contractor's work has been satisfactorily completed and that all contractual obligations have been met.

The opinions, findings, and conclusions expressed in this summary are those of the contractor and not necessarily those of the National Highway Traffic Safety Administration.

Availability: This report may be ordered in paper copy (PC) or microfiche (MF) from NTIS. Order by DOT/HS-800 372 or PB-196 952.



executive summary

YNPOSIS OF A RECENTLY RELEASED NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION RESEARCH REPORT

CRITERIA FOR THE DESIGN AND DEPLOYMENT OF ADVANCED GRAPHIC GUIDE SIGNS

The purpose for this contract was to develop highway guidance signs for interchanges that can be more easily read and understood than the existing sign guidance system.

Contract FH-11-7284
Serendipity, Incorporated
2001 Jefferson Davis Highway
Arlington, Virginia 22202
DOT/HS-800 373 PB-197 614

Award Amount: \$82,000.00
Contract Period: June 20, 1969
to September 20, 1970

NOTE: A companion document entitled, "Guidelines for Advanced Graphic Guide Signing" is included with the main report and carries the same accession numbers as above.

SUMMARY OF RESULTS AND CONCLUSIONS

Design Considerations

The study developed and tested systems of signing designed to better communicate roadway interchange and route guidance information to the driver. Emphasis was placed on determining the applicability of graphic or map signing compared to conventional guide signing. The study was designed to consider:

Interchanges where graphic guide signs should be considered, Techniques to test guide sign concepts in a laboratory, Graphic concepts and characteristics, and Presentation of results in a manner meaningful to highway and traffic engineers.

Results indicated that graphic guide signs permitted significantly better route guidance performance than conventional signs on certain interchanges (collector-distributor with lane drop, and multiple split ramps). Graphic signs also convey relative exit speeds and lane drop information effectively.

criteria resulted from a conceptual analysis of those interchange characteristics associated with traffic flow problems. Both the severity of the traffic flow problems and the potential impact of graphic guide signing were evaluated in developing the criteria. The criteria were used initially to select interchanges for laboratory testing. The testing, in turn, helped to select which types of interchanges would most benefit from graphic signs.

Where two or more of the following interchange characteristics occurred within a particular interchange, the use of graphic guide signing was recommended: heavy ramp volume, critical interchange points, perceptual problems (e.g., sight distance), and unexpected geometrics (e.g., inconsistent configuration).

Application of these criteria to existing interchange types led to the testing of the following types of interchanges: collector-distributor (with lane drop),

Test results indicated that graphic guide signs for the first two types significantly improved route guidance effectiveness.

To test the effectiveness of guide signs, laboratory techniques required by the contract, were developed. This required the selection and development of media for presenting sign concepts, and identifying criterion measures of effectiveness.

A technique of substituting photographed artist conceptions of test signs for existing signs was developed. The technique used two 35mm projectors with one projector showing a roadway scene with the guide signs blacked out and a second projector presenting test signs in the blacked out area for one second. The technique permitted testing numerous sign variables in a group setting in a short period of time.

Crucial to the development of a technique to determine signing effectiveness was the development of criterion measures. An analysis of the driver's route guidance task and a series of pilot studies led to the selection of:

Lane choice – selecting the most appropriate lane for a particular destination;

Confidence in lane choice (a driver who is not confident could be expected to slow down and perturb flow);

Anticipated interchange characteristics such as the ability to detect safe exit speed, number of exits, location of exits of interest, lanes used for through traffic and distance between exits; and,

Preference of sign types for different interchanges.

The primary emphasis of the study was the design and test of graphic concepts and characteristics that would be applicable to different interchange configurations. Graphic concepts were selected or developed from

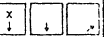
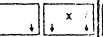
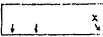
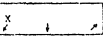
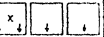
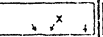
existing concepts and generated by a graphic artist, traffic engineers and a human factors specialist. Although numerous concepts were generated, pilot tests and logical analyses led to three basic graphic displays and one modification of conventional signs. The graphic concepts included the driver's eye perspective, the plan view (bird's eye view) and a performance oriented plan view. These were developed and tested for the six interchange types; see Table on page 24.

The results based on drivers making proper lane choice do not clearly favor one signing concept. The plan view was significantly better than the other graphic guide signs for the collector-distributor. There were no differences for the left exit multiple split ramp and the two rights from the main road. The plan view and performance constructed graphic guide signs were better than the modified conventional at a major fork. At a clover-leaf the modified conventional was significantly better than the driver's eye view or plan view. Confidence ratings were not helpful in discriminating signs.

Because of the difficulties encountered with the conventional signs and since a series of signs are normally presented at an interchange, sequential testing of conventional versus graphic guide signs was conducted. The results indicate significantly better performance using graphic signs for the collector-distributor ($p .01$) and multiple split ramp close choice points ($p .01$). The results generally are in agreement with the previous findings.

Graphic guide signs received significantly higher preference ratings on most of the interchanges. The aerial or plan view received significantly ($p .05$) higher preference ratings on all but the major fork, where the performance constructed graphic was preferred. The performance oriented and the plan view were similar for the major fork. It should be noted that the conventional signs were least preferred.

Table I, PROPER LANE CHOICE FOR VARIOUS SIGN CONCEPTS
BY INTERCHANGE TYPES

SIGN CONCEPTS	INTERCHANGE TYPES					
	LANE DROP	MULTIPLE SPLIT RAMP	RIGHT THEN LEFT	TWO RIGHTS	MAJOR FORK	CLOVERLEAF
CONVENTIONAL	1 	88 	86 	83 	82 	1 
MODIFIED CONVENTIONAL	54 	94 	96 	88 	72 	78 
DRIVER'S EYE	50 	98 	86 	78 	88 	50 
AERIAL OR PLAN	70 	96 	96 	82 	92 	54 
PERFORMANCE CONSTRUCTED	49 	92 	94 	82 	92 	64 

1. These signs were discarded since they did not strictly conform to current standards.

The "X" indicates the locations of the destination of interest.

The mean preference ratings for the "liked best" signs, the percent choosing the correct lane, and the mean confidence

Graphic design characteristics were tested to optimize the design of the signs. A summary of the design characteristics and their influence include:

1. Placement of exit information close to the termination of the exit arrow.	Increases correct lane choice (see No. 2 below).
2. Placement of exit information on the same side of the graphic as the one from which the exit departs.	Increases correct lane choice.
3. Larger amounts of graphic information.	Decreases correct lane choice.
4. Distance depicted between the exits.	No effect on correct lane choice but influences the perceived roadway distance.
5. Number of signs (given a fixed sign area).	No effect on correct lane choice.
6. Use of arrowheads vs. incorporation of information (e.g., shields) into the graphic.	No effect on correct lane choice.
7. Graphic size (within limits of discriminability).	No effect on correct lane choice.
8. Length of exit path.	No effect on correct lane choice.
9. Curvature of exit path.	No effect on correct lane choice but influences the estimate of the safe exit speed.

Finally, test of the ability of graphic signs to convey other information about an interchange indicate:

Curvature of the graphic can be used to estimate exit speed; and, Number of exits, exits of interest, and distance between exits can be more readily determined with graphic signs.

The Contract Technical Manager has certified that the contractor's work has been satisfactorily completed and that all contractual obligations have been met.

The opinions, findings, and conclusions expressed in this summary are those of the contractor and not necessarily those of the National Highway Traffic Safety Administration.

Availability: This report may be ordered in paper copy (PC) or microfiche (MF) from NTIS. Order by DOT/HS-800 373 or PB 195 949.

SPECIAL ANNOUNCEMENT

Automated searches of the Highway Safety Literature collection will be made upon request.

Specific subjects, as listed in the Table of Contents may be used. All requests must be submitted in writing with a clear, concise description of your needs.

Address requests to the

U. S. Department of Transportation
Technical Information Branch (43-33)
National Highway Traffic Safety Administration
400 7 th Street, SW.
Washington, D.C. 20590

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II Regional Administrator, NHTSA, 4 Normanskill Blvd., Delmar, N.Y. 12054, Tel: 518-427-4095. (New Jersey, New York, and Puerto Rico)

III Regional Administrator, NHTSA, Room 817 Federal Building, 31 Hopkins Plaza, Baltimore, Maryland 21021, Tel: 301-962-3678. (Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia)

IV Regional Administrator, NHTSA, Suite 200, 11720 Peachtree Road, N.W., Atlanta, Georgia 30309, Tel: 404-526-3405. (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee)

V Regional Administrator, NHTSA, 18209 Dixie Highway, Homewood, Illinois 60430, Tel: 312-799-6300. (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin)

VI Regional Administrator, NHTSA, 819 Taylor Street, Room 8A42, Fort Worth, Texas 76102, Tel: 817-334-2021. (Arkansas, Louisiana, New Mexico, Oklahoma, and Texas)

VII Regional Administrator, NHTSA, P.O. Box 7186, County Club Station, Kansas City, Missouri 64113, Tel: 816-361-7867. (Iowa, Kansas, Missouri, and Nebraska)

VIII Regional Administrator, NHTSA, Room 107, Bldg. 40, Denver Federal Center, Denver, Colorado 80225, Tel: 303-233-6429. (Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming)

IX Regional Administrator, NHTSA, 450 Golden Gate Avenue, Box 36096, San Francisco, California 94102, Tel: 415-556-5450. (Arizona, California, Hawaii, and Nevada)

X Regional Administrator, NHTSA, 5140 Federal Office Building Seattle, Washington 98104, Tel: 206-442 5934 (Alaska, Idaho, Oregon, and Washington)